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Research Order #1
Phase I - Progress Report #2

29 January 1954

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Research Order #1 29 January 1954
Phase I - Progress Report #2

OBJECTIVE:

To study and evaluate the factors and components involved in the design of a portable infrared communicator.

GENERAL DATA:

The work to be performed according to Bid Proposal #76-1, Phase I, may be summarized as follows:

A. Evaluation of sources and sensitive elements

B. Determination of beam width requirements and evaluation of "find-operate" systems

C. Study of modulation methods and attendant optical systems

D. Evaluation of power sources

E. Study of required circuit characteristics

The results of these studies will be used as the basis for recommending a system to be developed.

DETAILED DATA:

A. Evaluation of sources and sensitive elements

Literature has been received from the Hanovia Chemical and Mfg. Co. regarding high pressure mercury and xenon arc lamps. Of the numerous types listed, only three seem to be in the power range necessary, i.e., 25-50 watts. Of these, one is an argon-mercury; another is xenon-mercury; and the third is xenon only. All the lamps have luminous outputs equivalent to a tungsten filament operating in the range 3200 - 3400° K. In general, xenon arcs tend to be position sensitive

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and comparatively unstable if not operated in a vertical plane. However, the xenon only lamp has a greater percentage of its radiated power in the infra red region. This lamp is approximately 3 inches long and is tubular in shape. The diameter of the tube is not known, but unless it is in excess of 1-1/2 inches, its use would not be immediately eliminated. Two conflicting sets of data were received from the manufacturer for this lamp, and additional information is to be requested. One set rates the lamp at 25 watts (25 V @ 1 amp.), and the other rates it at 50 watts (25 V @ 2 amp.). The brightness in the former case is listed at 6 candles/mm^2 and 38 candles/mm^2 is the latter rating. Apparently the brightness varies quite considerably with power input. The life of the lamp from the latter data is given as 100 hours.

It appears that production specifications have not been solidified, but from the tentative data received it seems that these lamps may show promise - at least from an optical standpoint. Their electrical characteristics may eliminate them from consideration.

No investigation has yet been undertaken regarding sensitive elements for the receiver. The laboratory's new darkroom which has been under construction for several months is still nearing completion. Up until the end of this report period, the purchase of an air conditioner had been deferred. The tunnel, in order to fulfill our needs must be absolutely without light leaks. Much time has been spent searching out and patching each one. When new holes are cut for the ventilating ducts, we will have to finish the patching process. The skylight, which previously was the main source of leaks, has now adequately been taken care of with 1/4" plywood.

Mechanical parts for the optical range attenuator were completed in this period, but the optical components were slow in coming. However, it is expected that this unit will be completed ahead of its required time.

B. Determination of beam width requirements and evaluation of "find-operate" systems

During the period covered by this report, detailed

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drawings were made and mechanical parts completed for the beam simulator. The finalized ~~finalized~~ receiver characteristics are somewhat different from those given in Report #1. There are now provisions for only two acceptance angles: one of 22 minutes and the other of 71 minutes. The transmitter beam remains variable from less than one degree to eight or ten degrees.

Completion of this test equipment took longer than expected, due in part to glass parts which could not be made in our model shop. Data should be available from tests in time for the next report.

C. Study of modulation methods and attendant optical systems

No progress can be reported. A Bolsey "Frenelens" has been received, but its diameter (4") is too small to be considered for this application. A larger lens (10" D, 8" FL) is still forthcoming. A source for accurately, hand finished, glass parabolic reflectors has been found in Chicago. The manufacturer reports that these mirrors can be finished so well that all incident parallel light will come to a focus within a circle of confusion less than one wave length in diameter. This is far more precise than our requirements demand, and furthermore, it is believed cost and delivery would be excessive.

Methods of modulation have not yet been considered.

D. Evaluation of power sources

Letters of inquiry had been mailed to several manufacturers of model airplane engines late in December, but replies were not received until January. Of these, two were encouraging: one being from Forster Brothers of Lanark, Illinois, and the other from Cameron Precision Engineering Co. of Chino, California.

In general, a "Class B" engine (0.201-0.300 cu. in. disp.) will develop 0.4 to 0.5 hp at a speed of 12,000 to 14,000

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rpm. Although apparently no life tests have been made, the manufacturers expect about 100 hours of operation before repairs would have to be made. Replacement of parts (e.g., pistons, cylinder sleeve, bearings, rings, and crankshaft) rather than repair is the general rule. Weight of "Class B" engines averages around six ounces. This does not include the fuel tank. Nothing is known about the feasibility of adequately quieting them; and a further disadvantage is the specialized type of fuel they require (ordinarily a mixture of alcohol and castor or mineral oil).

E. Study of required circuit characteristics

It is still too early to delve deeply into the problem of associated circuitry. Theoretical studies into optimum speech band pass have been deferred until more manpower is available.

PROGRAM FOR NEXT INTERVAL:

Studies regarding the feasibility of various source-receiver element combinations will be undertaken prior to quantitative vacuum range testing. Specifically, modulation requirements, size, weight, and power requirements will be investigated. Also, beam width studies for "find-operate" modes can now be undertaken. It is hoped that sufficient data can be accumulated in this period from these studies to include in the next progress report. Searches for additional information on engines, generators, batteries, and various presently available acoustic-optical transducers (e.g., Dudde oscillograph and motion picture sound recording heads) will continue. Purchases for various electronic test gear (audio filters, decade and power amplifiers, etc.) will be initiated.

Report prepared by

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